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Global Models for Virtual Metrology and Closed Loop Process Control STEPHEN DANIELS, YANG ZHANG, BERNARD KEVILLE, EVGUENI GUDIMENKO, CHANEL HAYDEN, ANTHONY HOLOHAN, MILES TURNER, Dublin City University, NATIONAL CENTRE FOR PLASMA SCIENCE AND TECHNOLOGY TEAM — Global (0D) models of industrial plasmas have tremendous potential for informing virtual metrology schemes in IC manufacturing. These models can be integrated with feature scale simulators for process optimization and can be incorporated into closed loop process control schemes for within-wafer real time control of manufacturing tools. We will compare predictions from a global model of an industrially relevant plasma process, with experimental results obtained from process sensors and diagnostics, including actinometric OES, microwave resonance spectroscopy, and Langmuir probe analysis. The validity of the oxygen actinometry measurements is assessed using Laser Induced Fluorescence. The influence of wall interaction and wafer loading on the plasma process is examined. Real time, closed loop control of a laboratory capacitively coupled Ar/O2 plasma using OES and a microwave resonance probe as sensors is described. A dynamical process model, which includes a global model of the plasma chemistry, facilitates design and testing of the control algorithm. Model validation using step responses from the experimental process is discussed. The efficacy of the control algorithm is demonstrated by setpoint tracking and disturbance rejection over a range of operating points.

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